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Some implications of closure of Hamilton Inlet Bank to the commercial
cod fishery during the spawning season

by

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Comm.Doc. 74/15 requests a consideration of the effects of closure of Hamilton Inlet Bank during the cod spawning season.

Monthly landings

Tables 1-3 show the monthly cod landings in Div. 2J, 3K and 3L by the offshore fleet over the period 1967-72. Most of the landings in Div. 2J and 3K were taken in the winter and spring. The bulk of the landings in Div. 3L was taken in the spring and summer.

Time of spawning of cod on Hamilton Inlet Bank

Because of its limited capability to work in ice or in severe icing conditions, the *A.T. Cameron* has not been used to conduct winter surveys in Labrador and Northern Newfoundland. In a cruise conducted in Div. 2J from 6-19 April 1963, however, 56% of the mature males and 66% of the mature females had completed spawning (Table 4). In a cruise to the same area from 30 April-14 May of the same year, about 80% of the mature males and 87% of the mature females had completed spawning. It would appear that spawning is well in progress by early April and practically complete by the first part of May. It is considered here that the spawning period for cod in this area extends from February to April.

Monthly fishing effort and catch-per-unit-effort

The cod catch and effort statistics of Spain and Portugal were extracted from the Statistical Bulletin for the period 1967-72. The Spanish catch-per-hour was adjusted to that of Portugal by multiplying by a factor of 0.77. The fishing effort statistics for Div. 2J, 3K and 3L shown in Tables 5-7 were then derived from the catch statistics.

Effects of a closure to the cod fishery of Div. 2J, including Hamilton Inlet Bank, during February to April

If Div. 2J were closed to the cod fishery during the period February to April it could imply a reduction in catch in that division of about 60% and a reduction in effort of about 50%. In Tables 8 and 9 are considered a number of alternative ways in which this effort might be expended in Div. 3K and 3L. In each case it is assumed that the catch-per-hour was not affected when the effort was increased. The four ways considered were:

- a) all the diverted effort is spent in Div. 3K; fishing in this division maintains its average monthly pattern;
- b) all the diverted effort is spent in Div. 3L; fishing in this division maintains its average monthly pattern;
- c) half the diverted effort is spent in Div. 3K and half in Div. 3L; fishing in these divisions maintains its average monthly pattern;
- d) the diverted effort is expended in the February to March period in Div. 3K or 3L on a monthly basis depending on which division has the greater catch-per-hour.

Each of the four ways considered would result in a reduction in catch to the fleet ranging from 7-9%.

The effects of the diversion of effort on the cod stock complex of Div. 2J-3KLO would presumably be to decrease the fishing mortality rate in Div. 2J and raise it in Div. 3K and 3L if the fishing effort remained in Div. 2J-3KL. Templeman has shown the presence of an inshore-offshore migration of cod in this area. It might be expected that the inshore fishery would improve in Div. 2J but could worsen in Div. 3K and 3L.

Table / . Monthly landings (metric tons, round fresh) of cod from Division 2J, 1967-72.

Gears	Month	1967	1968	1969	1970	1971	1972	Average	%
Offshore	Jan	26361	22697	25991	26853	46441	69751	36349	15
	Feb	36949	92192	124094	89588	53819	16840	68914	29
	Mar	13677	74323	96945	39668	5952	3855	39070	17
	Apr	22088	27021	42660	16287	18516	27885	25743	11
	May	47653	46816	27650	4372	3434	959	21814	9
	June	10474	30981	18433	276	4259	368	10799	5
	July	266	1695	664	311	704	231	645	-
	Aug	318	1280	4304	5511	830	1233	2246	1
	Sept	4887	18708	4887	5781	1030	949	6040	3
	Oct	28122	22570	7190	3418	403	5094	11133	5
	Nov	11158	4789	2281	1078	1253	1705	3711	2
	Dec	10397	3168	1474	3680	2540	18673	6655	3
	NK	-	-	7	-	7722	495	1371	1
Annual		212350	346240	356580	196823	146903	148038	234489	101
Inshore	Annual	27726	12937	4328	1963	3313	1725	8665	
Total	Annual	240076	359177	360908	198786	150216	149763	243154	

Table 2. Monthly landings (metric tons, ~~found~~ fresh) of cod from Division 3K, 1967-72.

Gears	Month	1967	1968	1969	1970	1971	1972	Average	%
Offshore	Jan	873	5621	1334	1030	946	3388	2199	2
	Feb	4708	5913	893	14913	18917	100106	24242	28
	Mar	2075	3052	3270	22351	12957	1377	7514	9
	Apr	2153	6535	19733	10684	11599	8361	9844	11
	May	1400	2730	17855	6119	2504	5832	6073	7
	June	2467	33025	3757	1612	919	3733	7586	9
	July	2074	10783	4961	2792	1485	1898	3999	5
	Aug	4127	6482	2202	3852	1506	2551	3453	4
	Sept	13044	4487	7189	1804	1172	779	4746	5
	Oct	11186	12440	4926	1872	722	628	5296	6
	Nov	21832	19693	5894	1052	533	1756	8460	10
	Dec	11056	6354	2425	1409	217	1128	3765	4
	██	-	-	14	-	4958	592	927	1
Annual		76995	117115	74453	69489	58435	132129	88103	101
Inshore	Annual	24924	40768	24923	21511	21111	14054	24549	
Total	Annual	101919	157883	99376	91000	79546	146183	112651	

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Table 3 . Monthly landings (metric tons, round fresh) of cod from Division 3L, 1967-72.

Gears	Month	1967	1968	1969	1970	1971	1972	Average	%
Offshore	Jan	299	761	1628	711	576	3605	1263	1
	Feb	850	4475	1121	576	1916	6289	2538	2
	Mar	10571	19823	5363	4484	26611	13258	13352	8
	Apr	30597	30678	14726	25088	10684	17107	21480	13
	May	22426	18348	9730	18472	15336	16724	16839	10
	June	35396	19697	36181	24822	15205	12146	23908	14
	July	39781	37458	36760	19314	22232	6379	26987	16
	Aug	19173	39580	25166	15480	16604	8658	20777	12
	Sept	24704	30426	16484	17862	18967	11350	19966	12
	Oct	9942	9178	5816	7344	14141	8460	9147	5
	Nov	10893	6168	6661	7511	7156	5070	7243	4
	Dec	4136	2222	1566	1770	1886	1827	2235	1
	NK	198	-	8	12	1326	843	398	-
	Annual	208966	218814	161210	143446	152640	111716	166132	98
Inshore	Annual	49239	47330	67973	53113	38115	46928	50450	
Total	Annual	258205	266144	229183	196559	190755	158644	216582	

Table 4. Maturity stages of cod observed in April and May 1963 from random samples taken in ICNAF Div. 2J.

Sex	Maturity	Maturity stage	May			April		
			Number	%	%	Number	%	%
Male	Immature	-	137	-	43	266	-	57
		Mature	14	1	-	26	13	-
		15	12	7	-	65	31	-
		16	10	5	-	0	0	-
		17	149	82	-	116	56	-
		18	10	5	-	0	0	-
		Total Mature		182	100	57	207	100
Female	Immature		197	-	53	359	-	60
		Mature	52	10	6	-	31	13
		53	1	1	-	14	6	-
		54	4	2	-	18	7	-
		55	7	4	-	20	8	-
		56	154	87	-	163	66	-
		Total Mature		176	100	47	246	100

Description of maturity stages:

- 14 - male; maturing to spawn in the present year
- 15 - male; spawning
- 16 - male; spent in the present year
- 17 - male; spent in the present year, maturing to spawn in the next year
- 18 - male; maturing to spawn in the next year
- 52,53,54 - female; maturing to spawn in the present year
- 55 - female; spawning
- 56 - female; spent in the present year

Table 5. Monthly catch-per-standard-hour and number of hours expended in the cod fishery in ICNAF Div. 2J, 1967-72. Where catch-per-hour data was lacking, the estimates made are shown in parentheses.

Month	1967	1968	1969	1970	1971	1972	Average
Jan	3.734	4.599	3.438	2.249	2.121	1.423	2.13
Feb	3.024	4.029	3.927	3.063	2.116	(.949)	2.97
Mar	2.071	(3.374)	3.540	1.125	(2.244)	0.475	2.29
Apr	2.666	2.719	2.659	(1.278)	2.372	1.321	2.03
May	2.291	1.990	1.489	1.430	1.274	2.043	1.89
Jun	1.471	2.076	0.905	(1.149)	0.963	1.314	1.37
Jul	(1.532)	(2.030)	(1.050)	0.867	0.984	(1.111)	1.32
Aug	(1.532)	(2.030)	1.195	1.211	1.487	(1.111)	1.26
Sep	1.592	1.984	1.199	1.236	1.027	0.907	1.56
Oct	1.735	1.649	0.872	0.776	0.564	0.687	1.32
Nov	1.434	1.043	0.759	0.915	0.938	0.836	1.12
Dec	4.054	1.236	(.759)	1.469	1.076	1.278	1.50
							2.10
Jan	7060	4935	7560	11940	21896	49017	17068
Feb	12219	22882	31600	29248	25434	(17745)	23188
Mar	6604	(22028)	27667	35260	(2652)	8116	17055
Apr	8285	9938	16044	(12744)	7806	21109	12654
May	20800	23526	18570	3057	2695	469	11520
Jun	7120	14923	20368	(240)	4423	280	7892
Jul	(174)	(835)	(632)	359	715	(208)	487
Aug	(206)	(631)	3602	4551	558	(1110)	1777
Sep	3070	9429	4076	4677	1003	1046	3884
Oct	16209	13687	8245	4405	715	7415	8447
Nov	7781	4592	3005	1178	1336	2039	3322
Dec	2565	2563	(1942)	2505	2361	14611	4425

Table 6. Monthly catch-per-standard-hour and number of hours expended in the cod fishery in ICNAF Div. 3K, 1967-72. Where catch-per-hour data was lacking, the estimates made are shown in parentheses.

Month	1967	1968	1969	1970	1971	1972	Average
Jan	(2.192)	2.165	2.071	2.161	1.577	1.533	1.91
Feb	2.192	2.606	2.685	2.716	1.799	2.017	2.07
Mar	1.123	1.443	2.562	0.991	1.321	(1.774)	1.17
Apr	1.660	1.643	1.525	(1.079)	1.467	1.531	1.42
May	1.327	1.427	1.517	1.167	0.787	0.943	1.24
Jun	1.906	1.882	0.953	0.770	0.709	0.731	1.45
Jul	2.137	1.157	0.860	0.872	0.969	0.697	1.02
Aug	0.978	1.378	0.864	0.918	0.565	0.526	.89
Sep	2.989	1.382	1.129	1.287	0.941	0.552	1.58
Oct	1.473	1.396	0.812	0.652	0.648	0.779	1.16
Nov	1.296	1.371	0.758	0.742	0.815	0.854	1.18
Dec	1.429	1.189	0.984	1.095	0.912	1.127	1.25
							1.42
Jan	(398)	2596	644	477	600	2210	1154
Feb	2148	2269	333	5491	10515	49631	11731
Mar	1848	2115	1276	22554	9808	776	6396
Apr	1297	3977	12940	(9902)	7907	5461	6914
May	1055	1913	11770	5243	3182	6185	4891
Jun	1294	17548	3942	2094	1296	5107	5214
Jul	971	9320	5769	3202	1533	2723	3920
Aug	4220	4704	2549	4196	2665	4850	3864
Sep	4364	3247	6368	1402	1245	1411	3006
Oct	7594	8911	6067	2870	1114	806	4560
Nov	16846	14364	7776	1418	654	2056	7186
Dec	7737	5344	2464	1287	238	1001	3012
							61848

Table 7. Monthly catch-per-standard-hour and number of hours expended in the cod fishery in ICNAF Div. 3L, 1967-72. Where catch-per-hour data was lacking, the estimates made are shown in parentheses.

Month	1967	1968	1969	1970	1971	1972	Average
Jan	(1.886)	(2.255)	1.460	(1.514)	(1.767)	1.762	1.70
Feb	(1.886)	2.255	(2.251)	(1.514)	(1.767)	1.312	1.66
Mar	1.886	1.878	3.042	1.514	1.767	0.996	1.63
Apr	2.105	1.848	1.791	2.753	1.189	1.162	1.79
May	2.077	1.442	1.026	1.246	0.840	0.960	1.21
Jun	1.735	1.224	1.470	1.035	0.969	0.693	1.20
Jul	1.906	1.503	1.210	0.965	0.918	0.603	1.23
Aug	2.104	1.768	1.173	1.138	0.800	0.581	1.22
Sep	1.507	2.134	1.031	1.080	0.880	0.618	1.16
Oct	1.548	1.713	0.888	0.628	0.785	0.616	.89
Nov	1.406	1.386	1.457	0.915	0.720	0.639	1.01
Dec	1.647	1.237	0.763	1.041	1.391	0.923	1.18
							1.26
Jan	(159)	(337)	1115	(470)	(326)	2046	742
Feb	(451)	1984	(498)	(380)	(1084)	4793	1532
Mar	5605	10555	1763	2962	15060	13311	8209
Apr	14535	16601	8222	9113	8986	14722	12030
May	10797	12724	9483	14825	18257	17421	13918
Jun	20401	16092	25715	23983	15691	17527	19902
Jul	20871	24922	30380	20015	24218	10579	21831
Aug	9113	22387	21454	13603	20755	14902	17036
Sep	16393	14258	15988	16539	21553	18366	17182
Oct	6422	5358	6550	11694	18014	13734	10295
Nov	7748	4450	4572	8209	9939	7934	7142
Dec	2511	1796	2052	1700	1356	1979	1899
							131718

Table 8. Effects on the cod fishery in Div. 3K and 3L of the diversion of fishing effort during February to April from Div. 2J. Several possible alternatives are shown.

Alternative	Div.	Average yearly effort	Additional effort	Total effort	Yearly C/hr	Catch (metric tons)	%	Total	% Loss
Average 1967-72	2J	112000	-	112000	2.10	234000	48	488000	
	3K	62000	-	62000	1.42	88000	18		
	3L	132000	-	132000	1.26	166000	34		
	Total	306000	-	306000	1.59	488000	100		
1.	2J	112000	-53000	59000	2.10	124000	27		
	3K	62000	+53000	115000	1.42	163000	36		
	3L	132000	-	132000	1.26	166000	37		
	Total	306000	-	306000	1.48	453000	100	453000	7
2.	2J	112000	-53000	59000	2.10	124000	28		
	3K	62000	-	62000	1.42	88000	20		
	3L	132000	+53000	185000	1.26	233000	52		
	Total	306000	-	306000	1.45	445000	100	445000	9
3.	2J	112000	-53000	59000	2.10	124000	28		
	3K	62000	+26500	88500	1.42	126000	28		
	3L	132000	+26500	158500	1.26	199700	44		
	Total	306000	-	306000	1.45	449700	100	449700	8

Table 9. Diversion of effort in the February to April period from Div. 2J to Div. 3K and 3L by month depending on which division has the greater catch-per-hour.

	Div.	Average monthly effort	Additional effort	Total effort	Monthly C/hr	Catch (metric tons)	Total	% loss for the period
Feb-Apr average 1967-72	2J	53000	-	53000	-	133700	212700	
	3K	25000	-	25000	-	41600		
	3L	21700	-	21700	-	37370		
	Total	99700	-	99700	-	212700		
Feb	2J	23200	-23200	-	2.97	-		
	3K	11700	+23200	34900	2.07	72200		
	3L	1500	-	1500	1.66	2500		
	Total	36400	-	36400	2.05	74700		
Mar	2J	17100	-17100	-	2.29	-		
	3K	6400	-	6400	1.17	7500		
	3L	8200	+17100	25300	1.63	41200		
	Total	31700	-	31700	1.54	48700		
Apr	2J	12700	-12700	-	2.03	-		
	3K	6900	-	6900	1.42	9800		
	3L	12000	+12700	24700	1.79	44200		
	Total	31600	-	31600	1.71	54000		
Grand Total		99700	-	99700	1.78	177400	177400	17

Percent loss for the year = 7%

